Issue 25

July 2019

Utah Valley Amateur Radio Club

The UVARC Shack

What a difference a (Field) day makes

Celeste Davis, daughter of Ted Davis KI7BYT, shows us how it's done by making a contact with NI6BB, the battleship *USS Iowa*, at the 76ers Barbecue Saturday June 1st in Highland Glen Park. She was one of many who operated the K7GSL special event station that day, and in this photo accompanied by Matt Bowler KI7BQD, ahead of our regular Field Day setup.

In this issue of the *UVARC Shack*

Photos from Field Day with UVARC out at Strawberry.

Brass Tacks tackles the basics of electronic filters. A peek inside the shack of K7BUX. *The Amateur in You* explains what repeater systems are, and how it's possible to hear a legal, but out-of-band transmission.

Dear Annette answers a question about the need to ID on a silent SSB transmission. Discussion in *Hot Tips* on first ham steps. *DIY* features a simple 40-20 dipole antenna.

Please send your ideas, stories, questions, gripes, and photos to ***uvarcshack@gmail.com***

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Club meetings

Recap on the June meeting

June 2019 Club Meeting

Father-and-son Ryan (N2OW) and Tyler (KI7FUO) Simpkins teamed up to show us what CW (Morse code) is all about. Terrific presentation in which the two not only explained how CW works and how to work it, but engaged all of us by teaching us some code, and then tested our knowledge.

At the same meeting, Mel Parkes, recently re-elected ARRL Rocky Mountain Division Section Manager, presented Paige Ishii, KI7REQ, with a commendation and gift from ARRL for her outstanding service in the amateur radio community in helping with the rescue of a stranded traveler. She was featured in the June 2018 issue of the *UVARC Shack*.

Field Day

In photos

Field Day

In photos

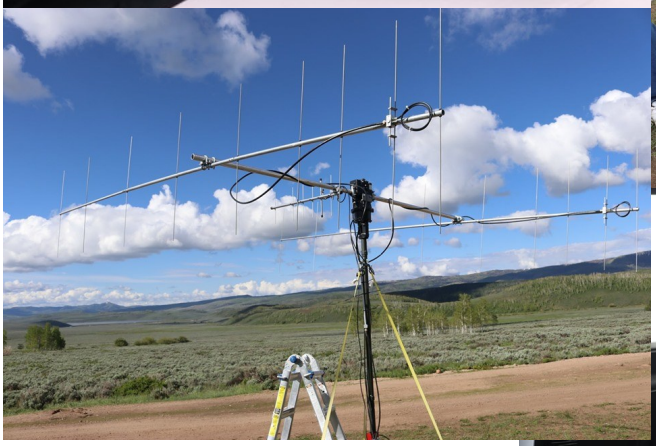
Our first snowy Field Day ever

Field Day

In photos

Field Day

In photos



Brian's satellite antenna

Field Day

In photos

Carl's 80-40-20-10-6 dipole antenna

GOTA "chopstick" 40-20 parallel dipole antenna

My Shack

Highlighting the shack (ham equipment and room) of a member, to give others an idea of the possibilities that might work for them

Jody Dollar, K7BUX

I've been a huge fan of radio communication since way back in the 1970s when I first learned that I could talk to others via radio. One of my first-ever memories was using my brother-in-law's CB to talk to other truckers. I thought that was just the coolest thing. Then came Burt Reynolds with *Smokey and the Bandit*! At that time, if I remember right, you had to have a license to operate a radio. Both amateur and Citizens Band. I wanted to get my license back then, but the Morse code was more than I could handle learning.

Then into the late 80s I purchased my very first 11-meter (CB) radio, since you no longer needed to have a license. Back then we used what we called a handle, or alias. Mine that I was known by, still to this day in the 4 corners of New Mexico is *Lil' Hoss*. The very first radio I purchased was the Cobra 148GTL, which was later modified (tweaked and peaked) to allow 80 channels to the already 40-channel radio. Not including all the upper and lower sidebands. It was my pride and joy. From that radio I talked to people all over the world using skip. Late nights were nothing uncommon back then.

Over time I picked up enough knowledge and equipment to learn how to peak my own and others' radios with Radio Shacks SWR / watt meters. I could take the Cobras from a 4.5 dead key with a 6 to 10-watt swing on modulation, to make it anywhere from 0.5 W with about a 20 W swing, depending on their radio and what they wanted.

One day I found a Baofeng UV-82 on KSL for $20, so I picked it up and began listening to 146.760 all the time. Shortly after getting my Technician ticket I studied and upgraded to a General license.

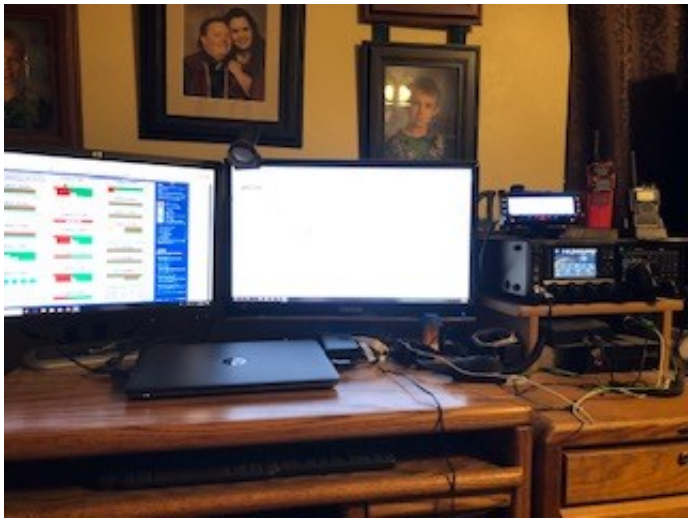
My Shack, continued

Jody Dollar, K7BUX

The most fun I have ever had on HF was the very first time being on the air, when I went over to the shack of my very good friend "Little Brother" Jeremy Giovannoni K7TEH and my first 5 contacts within 30 minutes all being European stations.

2016-03-26	22:14	OT5A	20m	14.331	SSB	JO21hc		Belgium	CONTEST CLUB
2016-03-26	22:11	SJ2W	20m	14.323	SSB	KP04hm		Sweden	Mikael Larsmark
2016-03-26	22:08	GM5X	20m	14.319	SSB	IO87wk		Scotland	Keith M Kerr
2016-03-26	22:01	DP7D	20m	14.312	SSB	JO32pc		Germany	HF Contestgruppe Schoeppinger Berg DP7D
2016-03-26	21:58	EF2A	20m	14.308	SSB	IN83xh		Spain	JON ZUMALABE
2016-03-26	21:43	IR4M	20m	14.288	SSB	JN64ca		Italy	Romagna Contest Team
2016-03-26	21:40	OM5ZW	20m	14.284	SSB	JN98dr		Slovak Republic	LUBO MARTISKA
2016-03-26	21:38	9A1UN	20m	14.236	SSB	JN65tf		Croatia	Davor Kucelin

That started the HF spark. I have since tried to talk as often as health and family would allow on the air. My thanks and knowledge go out to many of the members of the 76ers, along with some very good friends that are now SK operators (once an operator, always an operator.) Yes, heaven needs us too!! That's for you, Mike Searle WE7AA!!



My current inventory:

Yaesu FTdx1200 HF and 6 m transceiver
Yaesu FTM-350 dual-band transceiver
Many Yaesu, Kenwood, Baofeng HTs
Retevis RT3S DMR HT
Many Cobra CB radios
Pockrus J-pole antenna
G5RV antenna
All-band shortwave transceiver that was handed down to me after my father passed away

73, Jody K7BUX

Jody serves as a member of the UVARC Board of Directors, and is one of our founding members. He's also the annual star of the 76ers Santa Net every December and the UVARC Christmas Potluck.

Events

Upcoming happenings

Utah Valley Swapmeet

Large gathering of amateur radio enthusiasts

We had so much fun and success last year with our very first swapmeet, that we're going to do it again. The *2019 Utah Valley Swapmeet*, sponsored by the Utah Valley Amateur Radio Club, will be held on Saturday September 28 from 9 am to noon, in the Spanish Fork North Park Grand Pavilion, 1188 N 400 E in Spanish Fork, same as last year. Entry is $5 per person or $10 per family. The purpose of a swapmeet is to offer buyers and sellers an opportunity to get together and buy / sell / trade, plus the chance to rub shoulders with both new and long-lost ham friends. But this swapmeet will also provide the following:

- Demonstrations of amateur radio gear, including helping you get on the air (GOTA station)
- Information on many aspects of amateur radio, including HF, digital, APRS, SOTA, portable, and much more
- Opportunity for many ham radio clubs, social groups, and associations (76ers, Utah VHF Society, UVARC, UARC, UDXA, WDARC, ARRL, etc.) to recruit members
- Chance for service organizations (SLCOARES, UCARES, TCARES, DCARES, TERT, ERC, SAG, ARC, VEC, etc.) to invite and recruit members and inform attendees
- Radio programmers who could program your radio on the spot, depending on your radio model and where you live

The website for the Swapmeet is utahvalleyswapmeet.com. Hope to see you there!

Transcontinental RR Special Event Station K7R

On Saturday August 17 from 1 pm to 6 pm on Antelope Island, UVARC will be hosting its second-ever a *Special Event Station* (SES), this one to commemorate the 150th anniversary of the pounding of the golden spike to connect the first transcontinental railroad in the US. Called the ***First Transcontinental Railroad 150th Anniversary Special Event Station***, we've been given the special event call sign of ***K7R*** for the purpose and duration of this event.

For those unfamiliar with how a SES works, we'll set up an HF station, kind of like how we do at Field Day. For five straight hours, a variety of operators take turns calling ***CQ-CQ-CQ This is special event station kilo-seven-romeo CQ!***, each trying to attract attention to our special event, while a person sitting next to or nearby the operator logs each confirmed QSO (contact).

After the special event is over, maybe days later, the club will send out QSL (contact confirmation) cards to those we've logged.

To carry out this SES, we're going to need help. We need volunteers to operate the radio (license class doesn't matter), to log the contacts, to help set up the station (especially the antennas), to help take down the station, and to provide food or snacks for those involved.

We plan to spend most of our time transmitting on 20 meters (specifically **14.336**, **14.272**, and **14.242** MHz, whichever sounds the least busy) because it'll be daylight nearly the entire time. ***Note: the times and frequencies are subject to change!***

Please contact any member of the club leadership if you'd like to help. Or you can email ***uvarcinfo@gmail.com***

Events, continued

Even more happenings

Utah Valley Hamfest 2020

In our most ambitious project ever, we'll be holding our first-ever hamfest, a regional convention and gathering of amateur radio enthusiasts from Utah and surrounding states. The *Utah Valley Hamfest 2020*, sponsored by the Utah Valley Amateur Radio Club, will be held on Friday May 8 and Saturday May 9, in the UCCU Center of Utah Valley University (UVU), 800 W University Pkwy in Orem. Entry fees and times are being worked out. The purpose of a hamfest is to host seminars, breakouts, demonstrations, keynote speakers, vendors, small activities (build-it, fox hunt, HT programming, etc.), door prizes, and a flea market (swapmeet), bringing hams face-to-face from all over. But this hamfest will also provide the following:

- Kiosks such as *The Doctor is In* (get answers to difficult technical or political questions), *The Handyman* (get an Anderson connector installed, have some wires soldered, let us attach a PL-259 to your coax, etc.), and *Elmer Fudd*® (your new best friend)
- Amateurs Anonymous (AA) seminar, for those who need help with their addiction (to become *more addicted*), plus a special Am-Anon session for spouses :-)
- Information on many aspects of amateur radio, including HF, digital, APRS, SOTA, portable, satellites, EME, remote, and much more
- Exposure to many aspects of amateur radio not otherwise seen in club meetings and swap meets
- Special Event Station (SES) to draw attention to the hamfest and get you on the air

The website for the Swapmeet is utahvalleyhamfest.com. This will be fun!

We're looking for volunteers and helpers, especially from those who have talents in some specific areas, such as graphic arts, embroidering, RF technology, programming, logistics, antenna building, and more. If you'd like to help out, or at least be part of the planning and organizing, please contact James Brown W7JHB at w7jhb@hmpg.net or 801-376-7775.

ARRL Rocky Mountain Division Convention 2019

From Thursday August 8 through Saturday August 10, the ARRL Rocky Mountain Division will be holding a convention, which is very similar to a hamfest. This convention will be held at the Shepherd Union of Weber State University (WSU), and details have been posted on www.rmdc2019.org. Pre-register for $18 or register at the door for $25.

They'll have seminars, keynote speakers (Howard Michel and Bob Heil), special event station, swap meet, and door prizes.

These folks are also looking for helpers on planning, announcing, running the SES, manning the build-it tables, and manual labor. If you'd like to help, please contact Pat Malan N7PAT at patmalan@gmail.com

Brass Tacks

An in-depth look at a radio-related topic

Filters

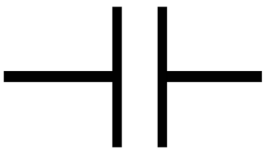
Last summer my wife and I were walking on the sand at Newport Beach, California, a few dozen miles southeast of Los Angeles. It was a terrific, sunny, summer day, so I was wearing my sunglasses, even wading in the water with them. But in a moment of weakness, when I was distracted by my beautiful wife, an unsuspecting wave came up and knocked the shades off my face, and I lost my eyewear to the ocean forever. Not a problem; we strolled to the nearest bungalow and purchased a $3 replacement for $45, and we were back to beach-combing in no time.

Once back outside, I noticed right away that everything around me had developed a deep shade of amber. I began to wonder how it was that a couple of pieces of plastic could make everything appear yellow. Then I realized that the yellow lenses on my shades didn't add anything to the light, but instead subtracted from the light. Objects within sight emitted or reflected white and other light waves into my sunglasses, but my sunglasses *filtered out* all the light, except that with the color yellow. Fascinating.

We ham radio operators might come to discover that our radios contain one or more electronic circuits or components that do something similar, but with electrical current (which I'll call a *signal*) rather than light waves. And because these circuits ***attenuate*** (reduce the amount of) certain signals passing through them, we refer to them by ***filters*** as well. But how do they work, and why should you care?

Truthfully, most of the electronic filtering you'll ever need to have done, will likely already be built into your radio or other equipment. Sure, there are those who build their own equipment, and so filter design becomes important them. Still, others just want to know. Filtering is a non-trivial subject in electrical engineering education, meaning it can be relatively simple, to overwhelmingly complex. In the interest of brevity, the scope of this article will be confined to passive, simple filtering, a small sliver of the pie, but the foundation presented here will help you grasp the basics.

The building blocks



capacitor symbol

The schematic symbol for a capacitor is drawn appropriately, as an open circuit. Without going through a complete explanation of capacitor theory, it indicates that no current can truly flow through one unless the direction of current flow constantly changes direction, which we call AC (alternating current.) When this current changes direction slowly, almost no current appears to flow through the capacitor, but the faster the current changes direction (increases in frequency), the more current appears to flow through the capacitor.

So, it seems that a capacitor can attenuate the amount of electrical current going through it, or allow a lot to seemingly go through it, simply because of the current's frequency. In this way, a

Brass Tacks

continued

simple capacitor is a filter of sorts, all by itself, by allowing high frequency signals to pass through it, while attenuating low frequency signals. In nearly the reverse behavior, an inductor is pretty much a short circuit at low frequencies, but will oppose changes in current at higher frequencies. Because of this, a simple inductor by itself is also a filter, allowing low frequency signals to pass through it, while attenuating high frequency signals. But, how high is *high*, and how low is *low*?

Just like sunglasses, filters don't stop *all* undesired signals from passing through, so engineers agree upon a -3 dB, or *half-power* design limitation. This means a successful filter permits less than 50% of the signal to pass through, at the design frequency. This frequency is

$$P_C/P_I = ½ = Z_I/Z_C \Rightarrow f_C = 1/2\pi RC$$

known as the ***cutoff frequency*** f_C (also called the *corner frequency*) for a series capacitor filter, resulting in signals of frequencies greater than f_C being *able* to pass through the filter, while those of lower frequencies are effectively attenuated. For a series circuit using an inductor, a similar calculation results in

$$f_L = R/2\pi L$$

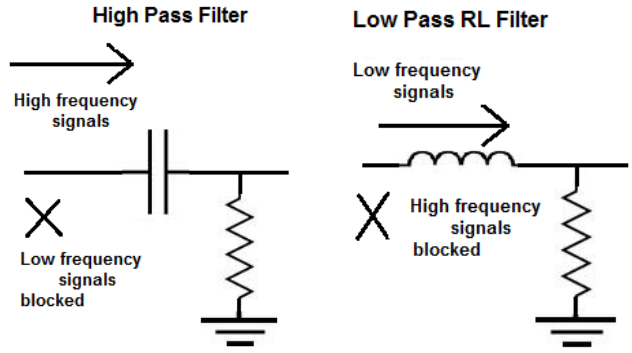
inductor symbol

Which in turn is the cutoff frequency f_L for the series inductor filter, resulting in signals of frequencies lower than f_L being *able* to pass through the filter, while those of higher frequencies are effectively attenuated.

High-pass, low-pass, shunt filters

In the crude capacitor example above, we call the component a ***high-pass filter*** because it essentially permits the current of the higher-frequency signals to pass through it, and attenuates lower-frequency signals (and so also called a ***low-cut filter*** because it cuts off the lower frequencies). Similarly in the inductor example above, we call the component a ***low-pass filter*** because it essentially permits the current of the lower-frequency signals to pass through it, and attenuates higher-frequency signals (and so also called a ***high-cut filter***).

Now, rather than rely on the resistance inherent in a component or its leads (wires), place a resistor of a known value to set the cutoff frequency of the high-pass or low-pass filter. Using both the resistance (R) and capacitance (C) values, you can design a simple RC circuit to meet your filtering needs. Use the same approach to design a simple RL circuit filter.

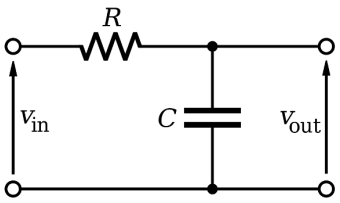


If you swap the resistor and capacitor with each other, then the higher frequency signals actually get "shorted to ground" instead of being passed to the circuit output. This is known as a ***shunt filter***. Connecting the two leads between the signal and ground will effectively *ground* the signals whose frequencies are greater than the cutoff frequency, and therefore is another way to create a low-pass filter, but with a capacitor. Of course, the high-

Brass Tacks

continued

pass shunt can be created by swapping the inductor and resistor in the second circuit example.



capacitor shunt filter

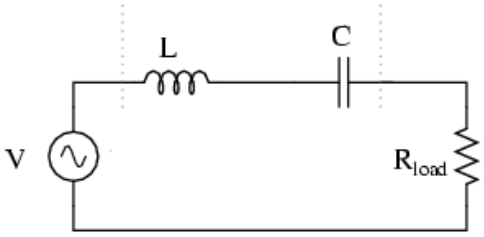
Let's say you have a smoke alarm or detector that keeps chirping every time you key up your 2-meter transceiver. The wires inside the device might be picking up your 2-meter transmissions like a small antenna. It's possible to create a small shunt filter to redirect the VHF signals to ground, while permitting all other lower-frequency (DC, in this case) signals to pass into the device. Let's assume that we need no more resistance than is provided by the wires in your series shunt filter, maybe 0.1 ohms. The idea is to filter out all signals of frequencies greater than 144 MHz, which means

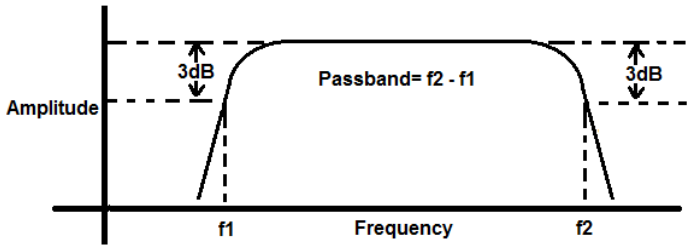
$$C = 1/2\pi Rf_c = 1/[2\pi(0.1 \text{ ohms})(144 \text{ MHz})] = 0.011 \text{ } \mu F$$

Install a 0.01 µF capacitor between a receiving wire (often, the DC power plus side) and the DC power minus side. Voila...no more chirping false alarms!

Band-pass and band-reject filters

Now that you're armed with the foundational knowledge you need to create the building blocks of passive filters, let's make something a little more complex with that information. Apply what we know, to create what's known as a ***band-pass filter***. Simply, allow to pass the signals of a band of frequencies you want, and attenuate the signals you don't want passing through. Consider the following circuit and its ***frequency response*** graph:





This series circuit contains both an inductor and a capacitor, which share the same current with the load resistor. In this case, high-frequency signals are attenuated by the inductor and low-frequency signals are attenuated by the capacitor. So, the only electrical signals effectively reaching the load resistor are those in between the low (f_1) and high (f_2) frequencies.

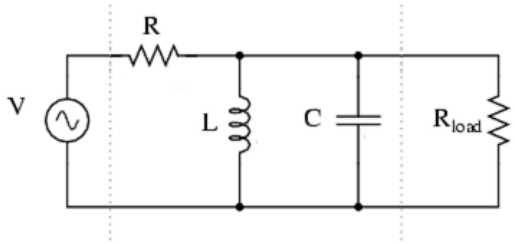
The effect of a band-pass filter is the result of combining a low-pass filter and a high-pass filter. The band of frequencies that the circuit allows to pass is known as the ***passband***, and the difference between the two cutoff frequencies ($f_2 - f_1$) is known as the ***bandwidth*** of the circuit. And if the bandwidth of such a filter is sufficiently narrow, we often refer to it as a ***peak filter***.

It's often useful to allow for a *variable* passband, so that only the desired signals of particular frequencies can be heard, for example, while signals from nearby frequencies and noise sources can be *tuned out*, a function known as ***passband tuning***.

Brass Tacks

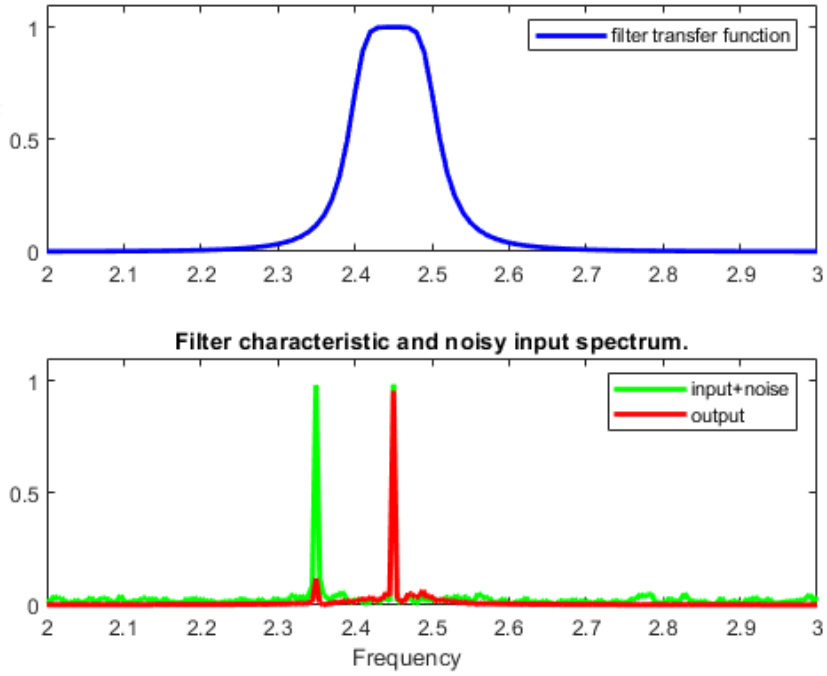
continued

The parallel LC band-pass circuit, such as the following, has a similar frequency response graph to that for the series circuit:



In this case, the unwanted signals are shunted to ground, the low frequencies by the inductor and the high frequencies by the capacitor, instead of being prevented from passing through. This version of the band-pass filter is known as a ***tuned circuit***, and has formed the basis for tuning radio receivers for many years. Using a tuned circuit allows your receiver to focus on a particular subset of frequencies for amplification and further processing, presenting you with audio modulated (encoded and carried) only within a small frequency range.

The following two graphs demonstrate a practical application for passband tuning, in which a strong noise source is present near the desired frequency of operation:



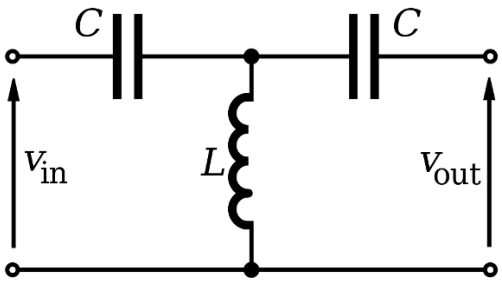
By adjusting the passband such that the frequency of the noise source is attenuated in one of the stopbands, it might be possible to filter much of the noise out of processing range, leaving only the desired signal.

Brass Tacks

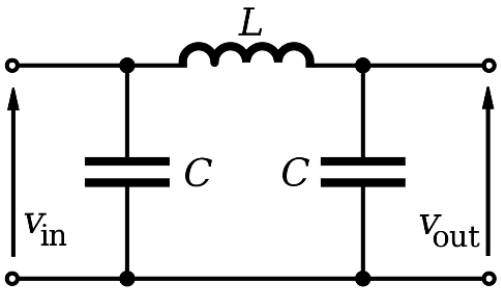
continued

It's often useful to create a filter that performs the opposite function; that is, allows to pass all signals of frequencies except those within a particular range. This is known as a ***band-reject filter***, with the region of frequencies being rejected known as the ***stopband***. And if the stop-band of such a filter is sufficiently narrow, we often refer to it as a ***notch filter***.

Other common passive filter types include those we often use for impedance-matching, such as the T-filter (also called T-network) and the Pi-filter (also called Pi-network), so-named because the shapes of the circuit schematics for them resemble the letters "T" and "π", respectively:

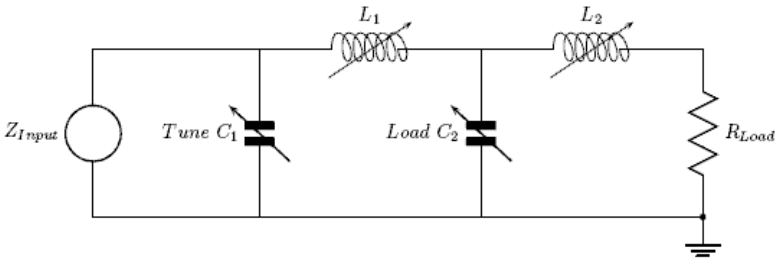


high-pass T-filter



low-pass Pi-filter

You can add more components to existing filters, to further shape the frequency response to your needs. The following schematic shows a general diagram of a tuner circuit, employing a Pi-L network, the output inductor L_2 added to the low-pass Pi-filter to help suppress harmonics:



The arrows through the capacitors and inductors indicate that they're variable, to allow adjustment of the filter impedance for matching at desired frequencies.

Finally, electronic filters can be designed using many components that we haven't explored, such as crystals, op amps (operational amplifiers), and discrete tubes and transistors. Also, many special-purpose and special-property filters have been designed, such as Chebyshev, Butterworth, crystal-ladder (often, crystal-lattice), roofing, elliptic, Jones, antennas (yes, antennas are filters too!), and many more. Designers of electronic equipment such as analyzers, oscilloscopes, and receivers, have used many of these complex filters to accomplish the magic their instruments are known for.

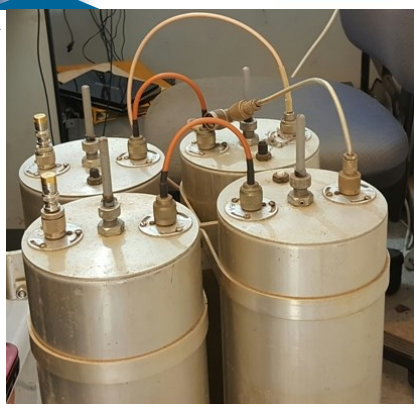
Brass Tacks

continued

One such special-purpose and special-property filter is a ***cavity filter***, designed primarily to keep the *repeater duplexer* transmit and receive signals on the same antenna from interfering with each other, and to prevent interference from other, nearby repeaters. It's a band-pass filter (in some cases, a notch filter) with an extremely small bandwidth, to reject signals close in frequency to that of the repeater signals. This narrow bandwidth is represented by a quantity called ***circuit Q***, which is calculated by

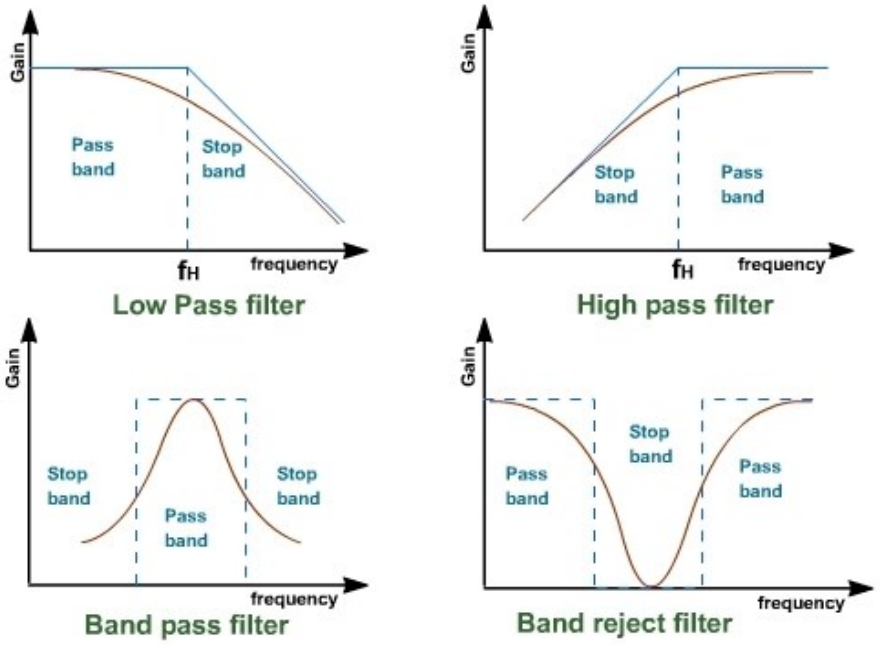
$$Q = f_C / (f_2 - f_1)$$

in which f_C is the center frequency, or the frequency of focus. As the difference between the cutoff frequencies decrease (bandwidth decreases), the Q increases.



repeater cavity filters

The following summarizes the different frequency responses of the filters we've discussed:



As mentioned previously, the information I've presented here is very simplistic, and is missing quite a lot of depth. For example, I've not mentioned anything about the introduction of phase shifts or nonlinearities as a result of filtering. My hope is to help you understand what a passive electronic filter is, without clouding the topic by complex side-tracks. But I believe I've provided some basics on which you can build your knowledge of filters, to at least begin removing some of the mystery behind these fundamental tools.

Noji Ratzlaff, KNØJI (kn0ji@arrl.net)

Dear Annette

What's on your mind? Serious, humorous, technical, and thoughtful answers to your deepest, (mostly) ham-related questions.

Dear Annette:

A couple of months ago, I came in possession of a spool of RG-6 coax for free. I realize it's made for cable TV, and not ideal for ham radio, but I also heard that it *can* be used as a ham radio feed line. Later, I asked a ham friend to install a connector on the end of that cable, but he didn't have the connectors or crimps for the cable. And none of my other ham friends do either. So, that got me thinking. Are we pretty much confined to purchasing only items that our friends use, or is there any latitude for trying out unusual things with ham radio projects any more?

Blair in Mona

Dear Blair:

Sounds like you've stumbled across an unwritten principle that has taken a few hams by surprise. The principle is ***get what your club uses***. For example, say you purchase a wonderful, feature-rich handheld radio for next-to-nothing, only to find that nobody you know has the programming cable to lend you for it, they don't know how to program it anyway, and the manual is nowhere to be found online. You might find that your investment is no more useful than a paperweight. Instead, stay with the mainstream, and get the same or similar equipment that others in your club have, unless you're confident that you don't need anybody's help with it. So, please experiment, try new things, and venture outside the proverbial box. Just keep in mind that the cavalry might not always be available to bail you out, if you start getting in over your head.

Dear Annette:

The other day out at Field Day, I accidentally pressed the talk button on the microphone while passing it to another guy, so I said I had better ID. He said I didn't need to, which confused me. I don't want to tell you his name because I really look up to him, and don't want to make him look bad. But I always thought I need to say my call sign to stay legal when I press the talk button on my HT at home, even if it's by mistake. What do you think? I need a second opinion.

Rush in Woodland Hills

Dear Rush:

Because you mentioned Field Day, I'm going to assume that the transceiver at the other end of your microphone was set to transmit SSB (single sideband) on HF (high frequency). If that's the case, your friend was correct. Most HTs can only transmit FM, meaning they transmit a *carrier signal*, which is *modulated* by your voice. But even if you don't speak into your HT microphone, when you press its PTT (press-to-talk) button, the radio will still transmit the carrier signal, requiring you to announce your call sign for the transmission. On the other hand, SSB has no carrier signal, so pressing your microphone PTT button without speaking into it will result in no transmitted signal at all. And if you didn't transmit anything, there's no need to ID. As for a second opinion, my opinion is that you're wise for asking about it, instead of assuming that your Elmer told you wrong.

Dear Annette:

Did you go to college to learn so much?

Sam in Orem

Dear Sam:

I did go to college, but I didn't learn everything I know from college.

Got a question for Dear Annette*? Email it to* ***uvarcshack@gmail.com*** *and include your town name. Sorry, no guarantees.*

The Amateur in You, Part 1

What have you been pondering?

Out-of-band reception

This question arrived originally for Dear Annette*, but its answer was sufficiently deep to warrant a mini-article for itself.*

Question: Recently I was tuning around and heard what sounded to me like an amateur radio QSO on 7.898 MHz, way outside the amateur bands. The two I heard both gave amateur call signs and sounded as though they were trying to follow the rules. Assuming they were, how was it that I heard them outside the ham bands?

Answer: There are a number of ways that these good hams could have their legal (assumed SSB, or single sideband) transmission heard outside the amateur bands. In the interest of brevity, however, let's consider three common ways: harmonics, IMD, and Image Response. (Others include splatter, reciprocal mixing, and corroded metal joints.)

To test whether 7.898 MHz is a *harmonic* of another frequency, simply divide the frequency by two, three, four, and five. Dividing any further results in harmonics that are typically attenuated (reduced) way below reasonably detected levels for SSB. (Digital can be detected at much greater attenuation.) 7.898 MHz ÷ 2 = 3.949 MHz, which is a legal frequency in the amateur 80-meter band. Also, 7.898 MHz ÷ 4 = 1.9745 MHz, a legal frequency in the amateur 160-meter band. Dividing by three and five do not result in values that fall within the amateur bands. Therefore, it's possible that you're hearing transmissions originating from either 80 meters or 160 meters, which is quite easy if the hams you heard were using multi-band antennas made of *traps*, for example, which are notoriously known for generating harmonics.

To confirm whether *IMD* (intermodulation distortion) is the cause, you can check *ballpark* figures, assuming the folks you're hearing are on amateur frequencies near the receive frequency. Since you're hearing them on 7.898 MHz, the IMD products will be described by either

$$7.898 = 2f_1 - f_2 \text{ or } 7.898 = 2f_2 - f_1$$

As a test, if we assume the nearby amateur frequency (f_1) is 7.272 MHz, for example, solve for f_2 in both cases

$$7.898 = 2(7.272) - f_2$$

$$f_2 = 6.646 \text{ MHz}$$

$$7.898 = 2f_2 - 7.272$$

$$f_2 = 7.585 \text{ MHz}$$

Neither 6.646 MHz nor 7.585 MHz are legal amateur frequencies, and both are far enough away from amateur frequencies, that we can *safely* conclude that IMD is not the culprit, even if we put all 40-meter phone frequencies to this test.

Image response can be checked in a similar fashion, only it's typically due to the superheterodyning effect, in which one stage of the conversion is producing the image. That conversion process might produce a product that you're hearing, so that an IF (intermediate frequency) of 3.151 MHz, for example would result in

$$14.200 \text{ MHz} - 3.151 - 3.151 = 7.898 \text{ MHz}$$

if the QSO you heard was on 14.200 MHz, for example. (Admittedly, an IF of 3.151 MHz is quite unconventional, but was contrived in this example for demonstration purposes only, rendering this cause unlikely.)

So, the conclusion is that, assuming the two you heard were attempting to transmit legally on SSB, you likely heard them outside amateur bands due to either harmonics (likely) or image response (much less likely), but probably not IMD.

The Amateur in You, Part 2

What have you been pondering?

Repeater systems

Repeaters are wonderful things. They allow us to talk easily with local folks, and make local nets sound like we're all next door to each other. But each repeater can only be reached by the operators within a particular geographical region we call the repeater's *coverage area*. If you want to talk with folks at a distant part of the state, for example, you'll need to either travel to an area covered by a repeater near those folks, or resort to methods such as EchoLink or IRLP.

Well, it turns out that some repeaters are *linked* with each other, such that they make it appear like you can talk locally with not only those in your own repeater's coverage area, but with folks in another repeater's coverage area too. A collection of repeaters that are linked this way is called a *repeater system*.

Utah has several repeater systems available, and they can actually get connected with each other, as demonstrated during the bi-monthly RACES Net. Most of these are *open* systems, meaning they'll permit anybody with a ham license to access the system without any special codes or links. Here are most of them:

Intermountain Intertie (IMIT)

Open system connecting repeaters near Boise, West Yellowstone, Malad, Lake Powell, Kanab, St. George, Las Vegas, Cedar City, Fillmore, Salt Lake City, Logan, Levan, Bear Lake, Flagstaff, and Evanston. You can actually link manually into the Arizona *Rimlink System* through the Navajo Mountain repeater of the IMIT. A person can drive the entire I-15 corridor from mid-Idaho to mid-Nevada, and use the Intermountain Intertie to carry on a lengthy, continuous conversation with an operator who is stationary in Provo, for example. From Utah County, access the Intertie by 147.120+ MHz (100.0 Hz tone).

Sinbad System

Open system connecting repeaters through north-central Utah, including some by Vernal, Orem, Myton, Price, Castle Dale, Hanksville, Monticello, Green River, Manti, and Mount Pleasant. From Utah County, access the Sinbad System by 147.080+ MHz (77.0 Hz tone).

Skyline System

Open system connecting several repeaters in central Utah, including some near Ephraim, Manti, Gunnison, Salina, and Monroe. At the moment, this system is connected full-time to the Sinbad System, so accessing a Sinbad repeater will place you on the Skyline repeater system as well.

Cactus Intertie

Private system, including many repeaters across much of Texas, New Mexico, Arizona, Utah, and California. Access to this system requires an annual $140 membership.

Western Reflector

Open system originating in Las Vegas connecting far-away locations such as Hawaii, Alaska, and much of the US. From Utah County, access the Western Reflector by 449.425-MHz (100.0 Hz tone).

Western Intertie Network (WIN) System

The WIN System is unfortunately unavailable from most of Utah, but would be quite useful if it was accessible. It's mentioned here, because it's one of the big ones in the western US.

UVARC Stack

The open repeater trio of UVARC (146.780, 224.560, and 448.200) is a *stack* of linked repeaters that act like a system, connecting repeaters, not of varying locations, but of varying bands at a single location.

Hot Tips

Good info for the new ham, and old stuff to refresh your memory

Taking your first steps in ham radio

Congratulations!

You've taken the time and effort to study, and celebrated when you passed the exam. Your reward for all of that work is a six-character call sign issued to you by the FCC. So, what are the first steps you should take, now that you're *legal*?

Get a radio and an antenna

Start out simple, like with a Baofeng UV-82 or Retevis RT85. But make sure you get a good antenna, like the Signal Stick. If you plan to transmit from your basement a lot, get a mag-mount antenna, like the Tram 1185, and a pig-tail for your little radio.

Make a contact

Tune your radio to 146.760- MHz (no tone) and say, ***Hello, this is KI7ABC. Would anybody like to talk to a new ham?*** Then, talk to another, and another, to get used to how it's done, and the habits and the jargon. Accept the advice of others.

Join a local net

Every Thursday night at 7:00 pm, tune to 146.780- MHz (100.0 Hz tone) for the ***UVARC New Ham Net***. Once you've gotten your feet wet and have made a few on-air contacts, every Wednesday night at 7:00 pm, tune to 146.760- MHz (no tone) for the ***76ers Net***.

Become a club member

Get online and start by visiting uvarc.club/join and sign up to be a member (dues-free) of the *Utah Valley Amateur Radio Club*. Then, join with the UVARC Facebook® group page at facebook.com/groups/uvarc and answer the questions. Belonging to a club enables you to find fast answers to your questions, and maybe help to do things, like program your radio or put up an antenna. And get involved! UVARC is non-profit and non-dues, so we depend on help from volunteers just like you.

Check in to your area net

No matter where you live, you likely have an ***area net***. An area is a geographical boundary defined by a city, that closely follows a religious boundary, such as an LDS stake or Catholic diocese or Jewish synagogue. Chances are, a local religious or city group has established a weekly net for your area, and your participation is welcome, whether you belong to any or none of the religious groups in your area. Try and locate your own area by visiting noji.com/nets and looking it up. If your area isn't listed, they might not have announced it yet, as of this publication.

Volunteer for service

In Utah County, become a member of ***UCARES*** (*Utah County Amateur Radio Emergency Service*) and learn how to get trained and involved. When there's a small emergency, there are usually plenty of police and fire and EMS folks who can handle it. But if there's a widespread incident (think earthquake, chemical spill, flood, or even terrorist attack), there simply won't be enough professionals to go around. And one critical component that will be missing is communication. UCARES can provide you with the training you need, to know how to help out in a time like that.

Most of all, have fun!

Enjoy your little radio. Play around with it. If you're into emergency / family preparedness, playing with a radio might not be your first choice of hobbies, but those who are most familiar with their equipment during a crisis will be of greatest help with communication.

DIY

Worthwhile projects you can build on your own

Simple dual-band (40-20) parallel dipole antenna

For the purpose of a setting up a quick and portable HF station at local events, such as barbecues, swap meets, and field exercises, I thought I'd create an antenna that is both simple to build and as effective as a dipole. The one featured here supports **40 and 20 meters**, does not suffer from the spurious harmonics of a trap antenna, and is based on my own design and calculations. I affectionately call it the ***chopstick antenna***. It does include a *balun* (meant only to connect the *unbalanced* to the *balanced* line), not the *transformer* (impedance-matching) type.

There are many multi-band dipole designs on the web these days, but most of them are the fan type, in which all the active elements meet at a common point and then spread out radially from each other. This particular design presents the elements in a parallel format, such that they still meet at a common point, but spread out parallel to each other. The parallel arrangement requires less vertical displacement, allowing the lowest elements of the antenna to be raised a little higher than that with a fan type.

Parts list

SO-239 bulkhead

— 55 feet of 16 AWG speaker wire pair
— One SO-239 flanged bulkhead connector
— Four 3/8″ x 36″ wooden dowels (round or square)
— Three 3/16″ zinc plated eye bolts with nuts, 1-½″
— 1-¼″ PVC tube, 3-½″ long
— Three #8 split washers
— Four M3-0.5 mm x 14 mm machine screws
— Four #8 x 16 AWG ring terminals
— One #4 x 16 AWG ring terminal
— Two 1-¼″ PVC slip (not threaded) caps
— Three #8 flat washers
— Four M3 split washers
— Four M3-0.5 mm hex nuts
— Small zip ties, ¼″ heat shrink tubing
— Four dogbone insulators (you can fabricate these from ½″ PVC, about 3″ long each)

Assembly instructions

Drill a 3/16″ hole in the center of one of the slip caps, and install an eye bolt through a flat washer on the outside of the cap. Slip another flat washer onto the eye bolt on the inside, followed by a split washer, then tighten a nut onto the eye bolt of the slip cap assembly and set aside.

Drill a 3/16″ hole in the side of the PVC tube 1-½″ from one end, which I'll refer to as the *top end*. Drill a ¼″ hole just ½″ below the top hole, placing it 1-½″ from the *bottom end*. Slip an eyebolt through a flat washer and into the top (3/16″) hole. Repeat these on the opposite side.

slip cap assembly

DIY, continued

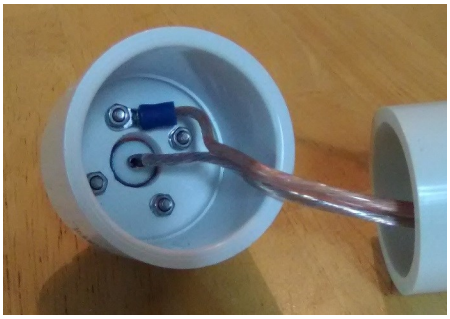
Simple dual-band (40-20) dipole antenna

Cut the 16 AWG speaker wire pair into two pieces, one 34 feet and the other 20 feet long, then separate the pairs. Thread one end each of the 34-foot wire and the 20-foot wire through one of the eye bolts, then into the bottom (¼″) hole below the side eye bolt. Slip a four-inch-long piece of heat shrink tubing over the two wires, and slide it into the bottom hole, to insulate the wires from excessive wear against the PVC tube bottom hole edge.

Strip the two wires going into the balun body, tie the two together, and solder a #8 ring terminal onto the tied pair. Slip a flat washer, then the ring terminal, and then the split washer onto the eye bolt thread inside the PVC tube. Loosely turn a nut over the thread and repeat this for the other side of the PVC tube.

Drill a ½″ hole in the center of the other slip cap. If your slip cap is domed (most are), rather than flat, it'll help with the installation to sand the outside of the cap so that the entire flange of the SO-239 bulkhead sits flush with the cap. Place the solder end of the SO-239 bulkhead into the ½″ hole on the outside of the cap, and using the mounting holes of the bulkhead as a template, drill a 1/8″ hole for each mounting hole, and deburr (remove the little pieces of shaved PVC from) them. Drill two more holes through the slip cap next to the SO-239 bulkhead flange, to drain.

Using a 6″ piece of the 16 AWG speaker wire pair, strip both sides of each end. Solder a #8 ring terminal to each conductor of one end and a #4 ring terminal to one conductor of the other end. Slip a piece of heat shrink tubing over the remaining conductor, then solder it to the center pin of the SO-239 bulkhead and shrink the tubing. Using the metric screws, washers, and nuts, bolt the SO-239 bulkhead to the slip cap, including the #4 ring terminal to one of the screws on the inside of the cap.



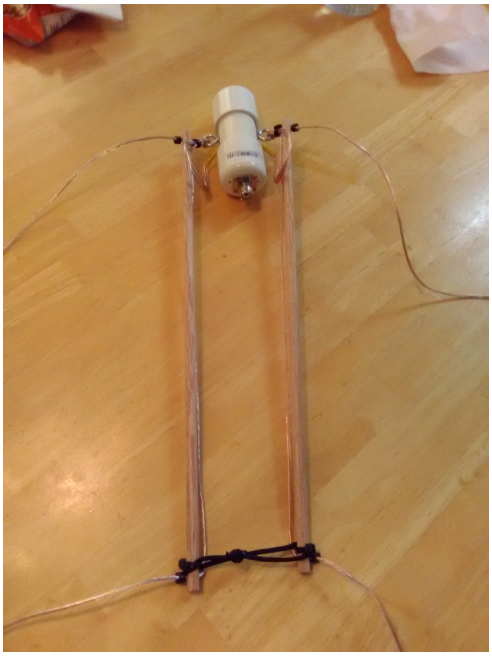
On the inside of the PVC tube, remove the nut and split washer from the side eyebolt. Place one of the #8 ring terminals of the SO-239 bulkhead onto the side eyebolt, followed by the split washer. Tighten the nut over the entire assembly, then repeat this for the opposite side. Zip-tie the element pair on one side of one of the side eye bolts to itself, on the other side of the same eye bolt, to form a large-enough loop through the eye bolt for a drip loop and to provide a strain relief. Center the four-inch heat shrink tubing in the bottom (¼″) hole, and shrink the tubing. Repeat this for the element pair on the other side eye bolt. This completes the balun assembly.

DIY, continued

Simple dual-band (40-20) dipole antenna

Cut all four dowels in half and sand the edges smooth. Drill a 1/8″ hole (or large enough to fit a single insulated speaker wire through) about ¾″ from each end of each dowel, making 16 holes. Thread one of the 34-foot wires through four of the dowels on one end of the dowels, and the accompanying 20-foot wire through the four opposing holes of the same dowels.

Position the first dowel (the one nearest the balun) such that the hole with the 34-foot wire is fairly snug against the eyebolt. Zip-tie the 34-foot wire on the side of the dowel opposite the balun, to prevent the dowel from slipping. Pull the 20-foot wire through the dowel bottom hole as far as possible, such that it's stretched about 17″ from the eyebolt to the dowel. Zip-tie the 20-foot wire on the side of the dowel opposite the balun. Position the second dowel about five feet from the first, and the third dowel about five feet from the second. Repeat all of this on the other side.



Insert the 34-foot wire through a dogbone insulator to measure 31 feet 10″ from the eyebolt to the dogbone. Wrap up to 6″ of the wire around itself, cutting off the excess. Insert the 20-foot wire through another dogbone insulator to measure 15 feet 8″ from the first dowel to the dogbone. Wrap up to 10″ of the wire around itself, cutting off the excess. Secure each wrap with two zip ties, and repeat this on the other side.

To keep the first dowels vertical, tie the bottom (20-foot) ends with a small length of paracord (photo to the left), and zip-tie the paracord in place.

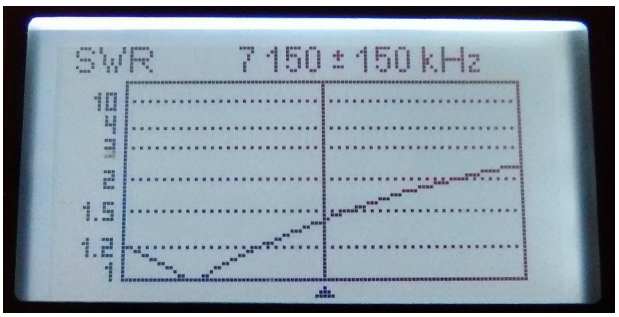
Provide a strain relief for your SO-239 bulkhead by routing your coaxial cable (RG-8X used here as an illustration) loosely over one of the eyebolts (photo to the right), around behind the balun, then over the other eyebolt. Connect the PL-259 connector of the coax to the SO-239 connector of the balun. Use a DMM (digital multi-meter) to perform a continuity test between all the wires and the balun center conductor, then likewise with the ground side.

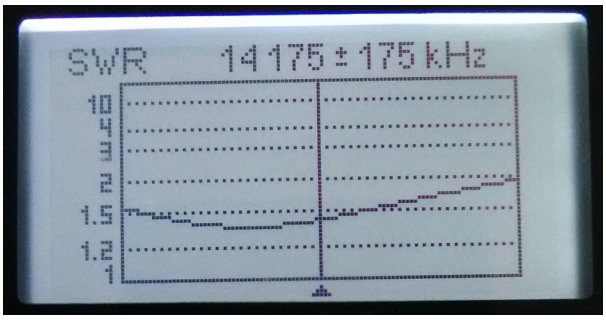
DIY, continued

Simple dual-band (40-20) dipole antenna

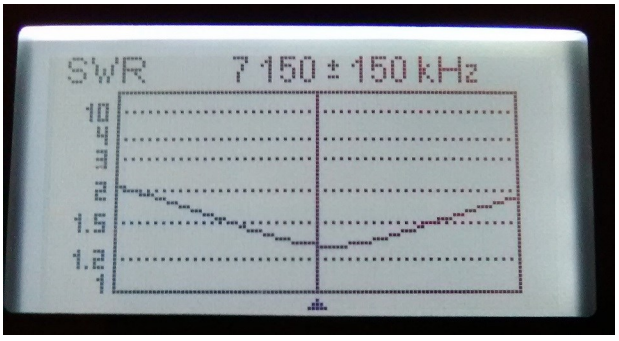
Testing the result

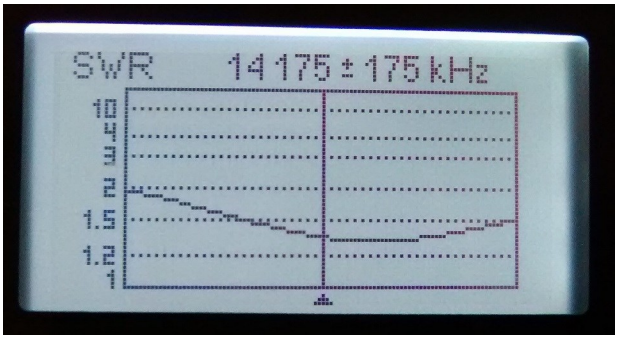
At last, it was time to take some measurements, and hope that my calculations weren't too far off. I put up a couple of 16-foot masts and hoisted the antenna to about 15 feet in the air. You can see from these initial readings that the antenna will work without a tuner on the 20-meter band, but needs a little help on the 40-meter band. Not bad for the first try.





My inner perfectionist told me I needed to tune this thing to remove the need for a tuner completely, however, so I started adjusting, cutting, and folding back, each time re-hoisting the antenna to take readings. After adjusting and re-adjusting the lengths of the elements, I discovered the sweet spots on the bands by adjusting the 40-meter elements to 32 feet 0″, with 8-¾″ folded back, and the 20-meter elements to 15 feet 8″, with 10″ folded back. The following show the final readings, which look really promising. I say *promising* because I didn't know for sure how the antenna would actually perform until I hoisted it 30 or more feet up in the air.



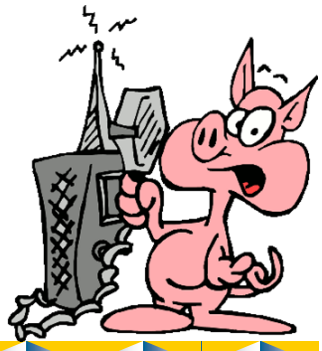


At that time, I took more measurements, but the real test came when I attempted to make contacts and request signal reports. This was the antenna I erected at the *76ers Barbecue* on Saturday June 1 and at the GOTA station at Field Day. And judging by the contacts made by both the kids and the ham adults at the Barbecue (see the front cover photo), I'd say it was pretty successful. Only thing I would add for a permanent installation is an RF isolator (such as a 1:1 current balun), to reduce the amount of common-mode current and resulting shack RF.

Noji Ratzlaff, KNØJI (kn0ji@arrl.net)

Side of Bacon

A little ham humor



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C	E	I	F	E	E	E	C	M	R	B	D	R	I
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UVARC
AMPLIFIER
TRAP
MORSECODE
SHACK
JPOLE
CROSSBAND
TECHNICIAN
GENERAL
HAAT
SQUELCH
BEAM
TONE
OPFCBGPLM
COAX
FEEDLINE
CARRIER
FILTER
GAIN
HAMFEST
BALUN
FIELDDAY
EHMWLMEK
CONTEST
DEVIATION
SWAPMEET

For Your Insight

Information you could use

Club meeting format

Here's the usual agenda for club meetings, at the Orem City Council Chamber Room, 56 N State St:

Talk-in frequency on the club repeaters

6:30 pm : Eyeball QSO

socialize / put faces with call signs

radio programmers available to help you

6:45 pm : Call the meeting to order

meeting lineup (agenda)

announcements / nets / awards / calendar

7:00 pm : Discussion / breakout session

discussions usually involve everybody

breakouts split into separate groups

7:45 pm : Door prizes

7:55 pm : Dismiss and disassemble

8:00 pm : *Club QSY* to a local eatery

Something you'd like to see at the meetings?

Monthly meeting help

We're grateful for the volunteers who help with various tasks that make our club night just that much more friendly and useful to everybody. Monthly we need help with

programming radios (thanks, Loren / Ralph / Mickey!)

taking photos or videos during the meeting

operating the talk-in radio

setting up tables and chairs (thanks, Heath!)

Lynx

Websites for your education and leisure

Training items and topics for nets

Ham Radio Nets

Radio programming

76'ers Group and UVARC Group pages

Utah Ham Radio Exam Schedule

Send your input to ***uvarcshack@gmail.com***

Questions of the Month

Test your knowledge (answers next page)

GØA12 : Which precaution should you take whenever you make adjustments or repairs to an antenna?

A. Ensure that you and the antenna structure are grounded
B. Turn off the transmitter and disconnect the feed line
C. Wear a radiation badge
D. All of these choices are correct

EØAØ4 : When evaluating a site with multiple transmitters operating at the same time, the operators and licensees of which transmitters are responsible for mitigating over-exposure situations?

A. Only the most powerful transmitter
B. Only commercial transmitters
C. Each transmitter that produces 5 percent or more of its MPE limit at accessible locations
D. Each transmitter operating with a duty-cycle greater than 50 percent

Calendar

What's happening
(times are Mountain Time)

Utah County Ham Exam Sessions

BYU J. Reuben Clark Law School building

Sign up at HamStudy.org/sessions

Wed July 17, 7:00 to 8:45 pm
Wed August 21, 7:00 to 8:45 pm
Wed September 18, 7:00 to 8:45 pm
Sat September 21, 2:30 to 5:00 pm
Sat October 12, 2:30 to 5:00 pm
Wed October 16, 7;00 to 8:45 pm
Sat November 16, 2:30 to 5:00 pm
Wed November 20, 7:00 to 8:45 pm
Wed December 18, 7:00 to 8:45 pm

Provo One-day Technician Courses*

Third Saturday Monthly at 8:00 am
BYU Law School Bldg, First Floor
** except May, June, July, and August*

2019 Orem Ham Radio Courses

Extra : July 16, 23, 30, Aug 6, 13
Technician : Sept 17, 24, Oct 1, 8

Club Meeting Calendar (6:30 pm)

Orem Council Chambers, 56 N State St

July 19*	August 1
September 5	October 3
November 7	December 5*
January 2	February 6
March 5	April 2

** Actually a potluck at 25 N Main St, Lindon*

Regular Nets

RACES Net, Thu August 15 8:00 pm, 147.12
Jackson Hole Net, Mon 8:00 pm, 146.76
UVARC Ladies' Net, Tue 7:00 pm, 146.78
UARC 76'ers, Wed 7:00 pm, 146.76
UVARC Family Net, Thu 6:30 pm, 146.78
UVARC New Ham Net, Thu 7:00 pm, 146.78
CERT Net, 2nd & 4th Thu 8:00 pm, 146.78
Utah County 6 meters, Fri 8:00 pm, 50.14
6-Pack Net, Fri 9:00 pm, 50.15
Family History Net, Sat 8:00 pm, 146.78
See a larger list of nets at noji.com/nets

Upcoming Contests

RAC Canada Day Contest
6 pm Sun June 30 to 6 pm Mon July 1

IARU HF World Championship
6 am Sat July 13 to 6 am Sun July 14

CQ World Wide VHF Contest
Noon Sat July 20 to 3 pm Sun July 21

European HF Championship
6 am to 6 pm Sat August 3

See a larger list at noji.com/contest

Answers to the Questions of the Month

GØA12 : **B** (Turn off the transmitter and disconnect the feed line)

EØAØ4 : **C** (Each transmitter that produces 5 percent or more of its MPE limit at accessible locations)

Vendors

For your convenience

Pockrus Joystick J-pole

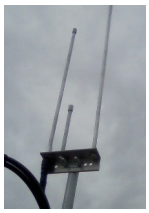
$25, open-stub aluminum half-wave, dual-band J-pole antenna

$35, 6-meter dipole, $20 for the 220 MHz (1.25 m) antenna

by Carl Pockrus, WE7OMG (email myjpoles@gmail.com to purchase)

Half-wave performance, solid construction, weather-proof, low wind-load

Probably the best-performing outdoor antenna you can get for the price



Super-Elastic Signal Stick

$20, vertical quarter-wave flexible antenna

by Richard Bateman, KD7BBC, of *SignalStuff* (and maker of *HamStudy*)

Super-performing antenna for your HT (handhold transceiver)

Visit SignalStuff and select SMA-Male, SMA-Female, or BNC

Ham Radio Podcasts v1.50

by Trevor Holyoak, AD7GH (email android@holyoak.com)

Stream podcasts (such as *100 Watts and a Wire*, *Amateur Radio Newsline*, *ARRL Audio News*, etc.) or download for later listening

For Android 4.1 and up (ad-free available for purchase)

Club Logo and Call Sign Embroidering

Want your call sign or name (or both!) embroidered on your shirt, your hoodie, your duffle? Or how about a club patch with your call sign?

by Glenna Gardner, WE7SEW (glenna0354@gmail.com or text 801-592-2503)

Call sign or name = $5, Both = $8, UVARC patch = $5, Patch with call = $9

Portable Aluminum J-pole

$49, sectioned, open-stub aluminum half-wave, dual-band J-pole antenna

by Stan, KJ7BDV and Kent, N7EKF (email skantenna@yahoo.com for info or call 801-372-7260)

Complete antenna breaks down into a compact 2″ x 6″ x 12″ package weighing only 3 lbs, perfect for backpacking and portable work where you really need a good 2-meter antenna

Maxfield Homebrew Antenna Supplies and Services

Components and services for the antenna home brewer

Military-grade hardware, clamps, standoffs, guy plates, round and square aluminum booms

Custom machining and welding

Email Barry Maxfield at maxfieldmachineTandD@cut,net or call 801-830-3904

Where everybody knows your call sign

Utah Valley Amateur Radio Club
Orem, Utah, USA

K7UVA
Phone/Text: 801-368-1865
Email: k7uva@arrl.net

Repeaters: 146.780–, 100.0
448.200–, 100.0 224.560–, 100.0
145.250-, 100.0 448.225-, 100.0
Newsletter input?
Email uvarcshack@gmail.com
Need help?
Email uvarcelmer@gmail.com

We're on the web!
uvarc.club

We are the *Utah Valley Amateur Radio Club*, a 501(c)(3) non-profit (EIN 81-360-6416) Utah corporation that was organized in an obscure Orem fire station on 02-05-2016 to provide amateur radio enthusiasts in Utah County and surrounding areas a way to gather and discuss all things ham. Our primary purposes are to provide a local amateur radio resource, help new hams in their new-found adventures, and to give more experienced hams a reason to share their wealth of knowledge and wisdom in a friendly atmosphere of fellowship. We're an ARRL Affiliate and work in cooperation with the Utah VHF Society, but are not subsidiary to them, to UARC, the 76'ers, UCARES, RACES, the SCATeam, or any other organization, although many of our members and leaders might also belong to the same.

This newsletter is copyrighted and published by the Utah Valley Amateur Radio Club, and its purpose is to convey the tone and temperament of the club, to inform and entertain its members, and to entice the rest. To join, go to uvarc.club/join or to www.facebook.com/groups/uvarc/ and request membership. For more information about our club or about amateur (ham) radio in general, please email or text or call us.

More than just a club, we invite you to become part of a great ham radio movement in Utah Valley

Our fearless leadership

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Vice President..... Chad Buttars
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Heath Stevenson
Orem City Emergency Manager

From all of us to you, 73